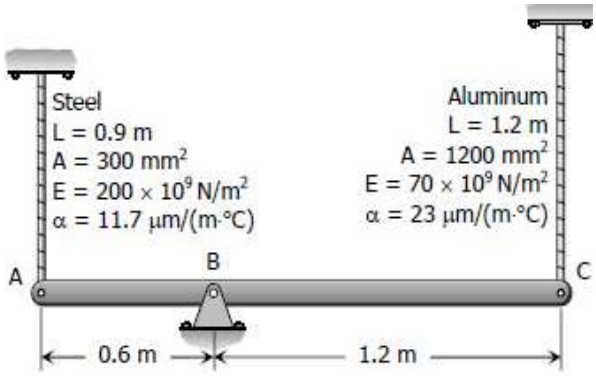
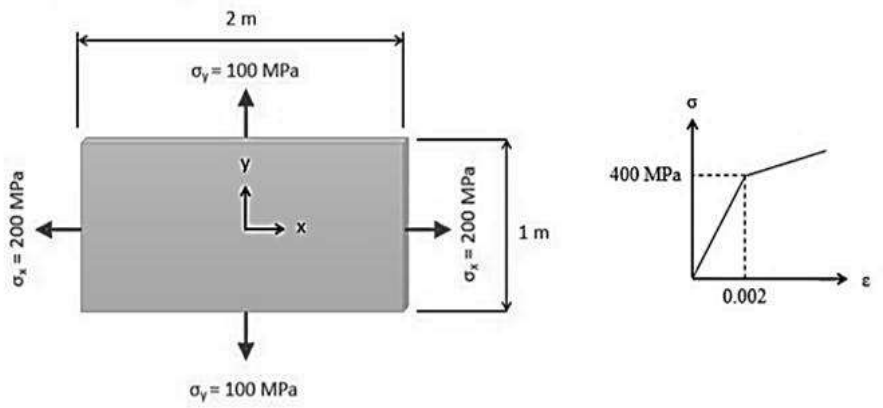
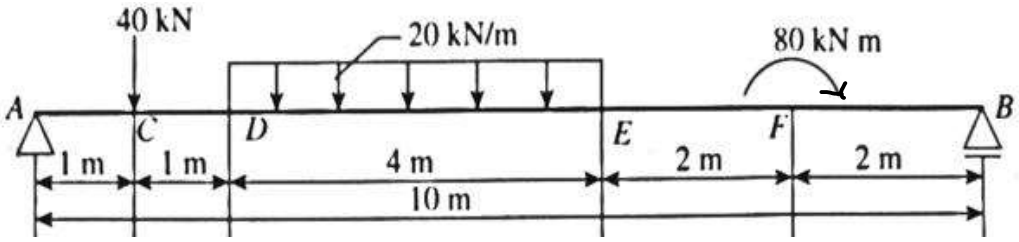
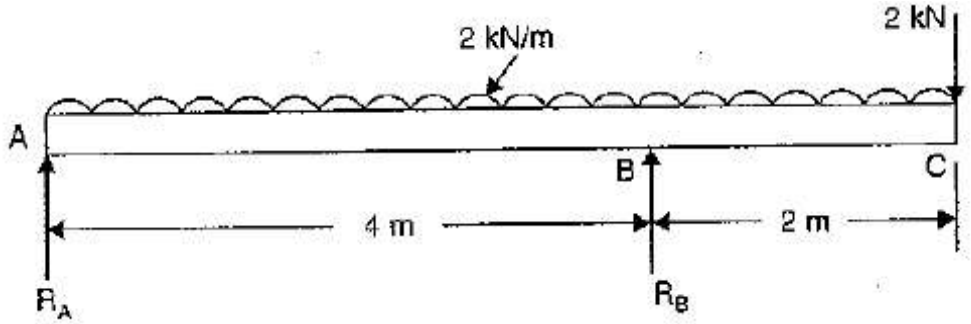
SVKM's
D. J. Sanghvi College of Engineering

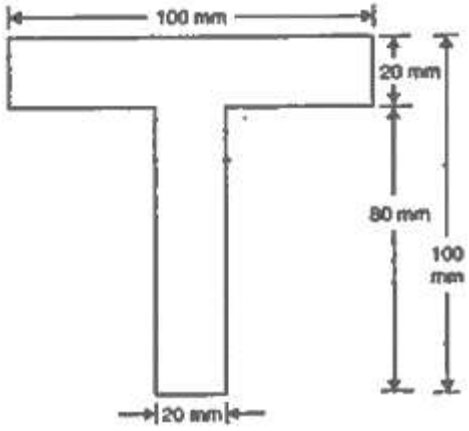
Program: B.Tech in Mechanical Engineering **Academic Year: 2022** **Duration: 3 hours**
Date: 23.01.2023
Time: 09:00 am to 12:00 pm
Subject: Strength of Materials (Semester III) **Marks: 75**

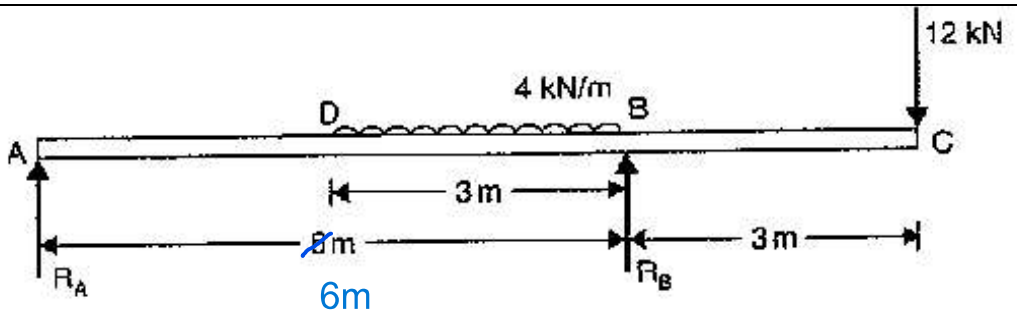
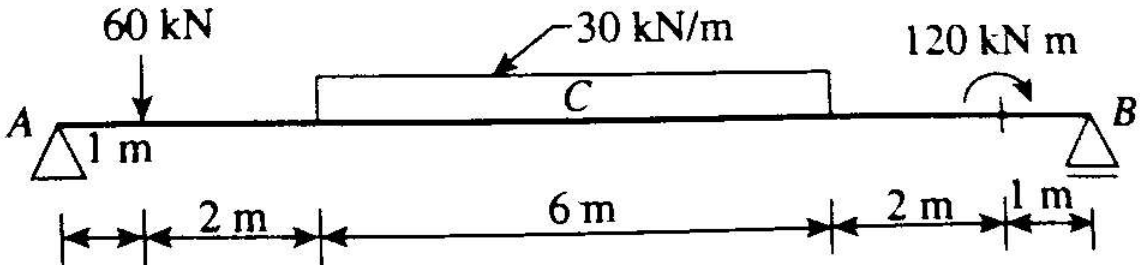
Instructions: Candidates should read carefully the instructions printed on the question paper and on the cover page of the Answer Book, which is provided for their use.

(1) This question paper contains three pages.
(2) All Questions are Compulsory.
(3) All questions carry equal marks.
(4) Answer to each new question is to be started on a fresh page.
(5) Figures in the brackets on the right indicate full marks.
(6) Assume suitable data wherever required, but justify it.
(7) Draw the neat labelled diagrams, wherever necessary.

Question No.		Max. Marks
Q1 (a)	The rigid bar ABC in Fig. below is pinned at B and attached to the two vertical rods. Initially, the bar is horizontal and the vertical rods are stress-free. Determine the stress in the aluminum rod if the temperature of the steel rod is decreased by 40°C. Neglect the weight of bar ABC.  **OR** A 20 mm thick plate subjected to biaxial state of stress, stress and strain diagram of materials as shown below and material has Poisson's ratio 0.3. a. Determine modulus of elasticity b. Compute normal strain in x and y direction. c. Calculate change in length along x and y axis. d. Find the principal stresses and maximum shear stress if τ_{xy} =50 MPa	[10] [10]

		
Q1 (b)	Draw stress strain curve for ductile and brittle material and also explain factor of safety with the help of stress strain diagram for both.	[05]
Q2 (a)	Draw the Shear force diagram and Bending moment diagram for thr beam as shown in fig below.  **OR** Draw the shear force diagrama and bending moment diagram for thr beam as shown in fig below. 	[10] [10]
Q2 (b)	Derive relationship between Bending moment ,Shear force and rate of loading.	[05]

Q3 (a)	A cast iron beam is of T-section as shown in fig. the beam is simply supported on a span of 8 m. The beam carries a uniformly distributed load of 1.5 kN/m length on the entire span. Determine and plot the maximum tensile and maximum compressive stress.  	[10]
Q3 (b)	Derive expression for core section in circular cross section. **OR** A beam of rectangular cross-section with height 250 mm and with 100 mm is subjected to shear force of 10,000 N. calculate shear stress at neutral axis. Plot shear stress distribution across cross section.	[05] [05]
Q4 (a)	Determine the diameter of a solid steel shaft that will transmit 350 kW at a speed of 100 r.p.m, if the allowable shearing stress is 90 MPa. What percent saving in weight would be obtained if this shaft is replaced by a hollow one whose internal diameter equals to 0.65 of the external, the length, the material and maximum shear stress being the same. **OR** A hollow shaft of diameter ratio 3/8 is to transmit 375 kW power at 100 r.p.m. The maximum torque being 20% greater than the mean. The shear stress is not to exceed 60 N/mm^2 and twist in a length of 4 m not to exceed 2°. Calculate its external and internal diameters which would satisfy both the above conditions. Assume modulus of rigidity, G = 0.85 x 10^5 N/mm^2.	[10] [10]
Q4 (b)	Explain the term strain energy, resilience, proof resilience, toughness with help of diagram.	[05]
Q5 (a)	Find the slope and deflections at critical points for beam shown in fig below. Determine slope and deflection at point C. I=5 x10^8 mm^4, E=2 X 10^5 N/mm^2	[10]

	 6m **OR** A simply supported beam of span 12 m carries loads as shown in fig Find the slope at end and deflections at C. 	[10]
Q5 (b)	A hollow cylindrical column with both ends pinned, is 6 m long and has outer diameter of 120 mm and an inner diameter of 80 mm Compare the crippling load obtained from Euler's load and Rankine's Take σ_y=550 N/mm^2 and Rankine's constant α=1/1600, E=80,000 N/mm^2.	[05]